



Gut Check: Cholera, Vaccines, and the Biology of Global Health

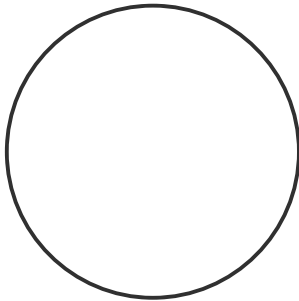
Name: _____

Hour: _____

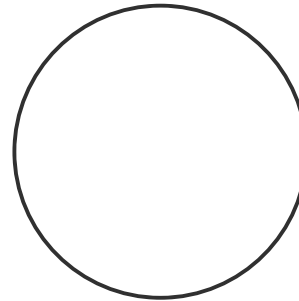
Directions:

You are a health practitioner in Bangladesh. Your job is to diagnose patients by examining their stool samples. After viewing each sample, draw, color, and label each specimen in the circles below.

Stool Sample A



Stool Sample B



Part A Questions:

1. Describe the differences between the two stool samples.

2. *Vibrio cholerae* is a bacterium that causes an infection of the small intestine called cholera. The main symptoms of cholera are severe watery diarrhea and vomiting. Which stool sample is from a person afflicted with cholera?

3. After reading the short Pulitzer Center article *Meet the Bangladeshi Scientist Who's Helping the World Fight Cholera* by Martin Enserink, complete the table below.

<https://pulitzercenter.org/projects/meet-bangladeshi-scientist-whos-helping-world-fight-cholera>

What are the issues?	What are the solutions?	What do you wonder?

Part B Questions:

1. After examining a World Health Organization map and graph, which regions are most impacted by cholera?

2. Why do you think these regions are most impacted?

3. After watching the video, *The Story of Cholera*, how is cholera typically spread?

Part D Directions:

Read the Pulitzer Center article *In the Cradle of Cholera* by Martin Enserink and answer the following questions. <https://pulitzercenter.org/stories/cradle-cholera>



1. Why is the distribution of the cholera vaccine challenging?
2. How long does the vaccine provide immunity against cholera?
3. Explain how the United States is impacting the cholera epidemic.
4. What is contained in the oral rehydration solution?
5. Of the 173 million people in Bangladesh, how many live below the poverty line?
6. If people in poor areas of Bangladesh have access to chlorinated water, why are they still getting infected with cholera?
7. What is in the oral cholera vaccine Dukoral?
8. Looking at the timeline, what is the current status of the global stockpile of cholera vaccine?
9. Who came and/or supported the meeting Dr. Quadri helped organize to address the cholera vaccine in 2007?
10. What did Dr. Quadri do when 700,000 refugees from Myanmar fled to Bangladesh to prevent a cholera outbreak?
11. How has climate change made cholera outbreaks worse?
12. Why did Sanofi, the French pharmaceutical company, stop making cholera vaccines?
13. How many suppliers are there of the cholera vaccine when this article was written (Feb. 2025)?
14. Summarize the work of Dr. Firdausi Qadri and why she is so respected.

Part E Directions:

To understand the immune response without and with vaccines, your team will examine Immune Cartoon Cards created by Dr. Valentina Hoyos Vélez.

1. Working with your team, put the first set of cards in the correct sequence to showcase how a pathogen (SARS-CoV-2 that causes COVID-19) triggers immunity in an unvaccinated person. Be prepared to explain the card sequence and events depicted.
2. Sequence the second set of cards to showcase how being vaccinated impacts immunity against a pathogen. Be prepared to explain your reasoning.



Part F Directions:

Read chapter 2, “First Do No Harm” from the *Story of Life* by Sean B. Carroll, then answer the following questions. <https://digital.wwnorton.com/storyoflife>



Hippocrates: The Father of Medicine

1. What year was this study published in the medical journal *The Lancet*?
2. How big was the sample size of patients affected?
3. What is “regressive autism”?
4. Why did some parents and some physicians suspect an environmental trigger for “regressive autism”?
5. Which vaccine were the parents or physicians linking the symptoms to?
6. At what age are MMR vaccines administered in the UK?
7. Who was the lead author of the study?
8. What is the second headline mentioned in the article?
9. How long had the MMR vaccine been in use in the US when this study was published?
10. Summarize what a chairman said at the 2000 hearing to get to bottom of this matter.
11. At the hearing, one parent said they are “seeking greater _____”.
12. At the hearing, Dr. Wakefield said he had studied 150 more children. How many did he say developed autism due to the vaccine?
13. While some supported Wakefield’s findings, Professor Brent Taylor concluded after looking at 293 cases of autism that there “was _____ difference in the age of children diagnosed with autism who had _____ the vaccine and those who were _____ vaccinated”.
14. The title of this section is “firestorm”. Did Dr. Taylor’s testimony put this issue to rest?
15. What high-stakes dilemma did this controversy evoke with parents?
16. The Danish study involved ~440,000 children who received the MMR vaccine and ~97,000 who did not receive the MMR vaccine. What did it conclude?
17. The Danish study did not put this issue to rest because of some parents noting the “_____ of the childhood immunizations and _____ symptoms in their children seemed too close to be a mere _____”. (paraphrased)
18. Why was thimerosal containing mercury added to some vaccines?
19. Was this mercury-containing preservative in the MMR vaccine?
20. In an attempt to eliminate the controversy, what did the vaccine-makers do to all childhood vaccines?
21. How did removing the mercury from all childhood vaccines backfire?
22. What did large-scale studies in the US and Finland conclude?
23. Other scientists were not able to repeat Wakefield’s findings because “the subjects were not _____, they were selected for their _____ and the proximity (timing) of the _____ to MMR vaccination...also it was a _____ sample of twelve”. (paraphrased)



24. How many years later did the truth come out about Wakefield?
25. Where did the \$90,000 funding for Wakefield's study come from?
26. What other stunner was revealed about several of the children in Wakefield's study?
27. Of the original 12 authors, how many retracted a possible link between the MMR vaccine and autism?
28. Aside from the \$90,000 funding for research from the law firm, how much more money did Wakefield get from the law firm over the next few years?
29. The tainted study with conflicts of interest and medical misconduct, and the impact of claiming a link between vaccines and autism led to the British Medical Licensing Board to launch an official investigation that ultimately led to what consequence for Wakefield?
30. It was also later found that most, if not all, of the children in the original study were reported inaccurately and hence, the study was an "elaborate _____" and the article was retracted from *The Lancet*.
31. A decade after the Wakefield publishing people still mistrusted vaccines (and many still do today). What outbreak rebounded in 2007-2008 in Great Britain due to the public's mistrust of vaccines?
32. T or F Measles today is a leading cause of death among young children despite a measles vaccine being readily available.
33. What is the most likely cause of autism according to most scientists?

Facts Over Fear: Vaccine Advocacy Project

Part G Directions:

1. Some people continue to have mistrust and hesitancy towards vaccines. Visit the website ivaccinate.org to learn more and to see what common questions people have, or ask your own!

2. Create a flyer that combats one or more vaccine concerns with scientific reasoning.

3. The flyers should be understandable by the general public (simplify the science!), include visuals, be colorful, and succinctly written (not too wordy). Irony and humor is encouraged if it will drive home the message and be impactful. Keep it school-appropriate!

Ask yourself, if someone walked past your flyer and glanced at it for one minute, would they get the key takeaway that vaccines are safe and effective?

4. You can create a flyer individually or in pairs with a classmate from your hour. It can be done by hand or digitally. No AI-generated images or AI-generated flyers are to be used.

5. Due Date: _____



Vaccine Advocacy Flyer Grading Rubric

Name/s: _____ Hour: _____

✓ Scientific Accuracy & Communication

- The flyer clearly and directly explains the science without being wordy.
- The science is accurate.
- It is easy for anyone to understand.
- No grammar errors or spelling errors.

✓ Visuals & Design

- Visuals, graphics, or drawings are used (handmade or digital without AI).
- The flyer is colorful, neat, and eye-catching.
- Humor or irony (if used) is school-appropriate and strengthens the message.
- Final product is original and shows real effort.

Vaccine Advocacy Flyer Grading Rubric

Name/s: _____ Hour: _____

✓ Scientific Accuracy & Communication

- The flyer clearly and directly explains the science without being wordy.
- The science is accurate.
- It is easy for anyone to understand.
- No grammar errors or spelling errors.

✓ Visuals & Design

- Visuals, graphics, or drawings are used (handmade or digital without AI).
- The flyer is colorful, neat, and eye-catching.
- Humor or irony (if used) is school-appropriate and strengthens the message.
- Final product is original and shows real effort.

Vaccine Advocacy Flyer Grading Rubric

Name/s: _____ Hour: _____

✓ Scientific Accuracy & Communication

- The flyer clearly and directly explains the science without being wordy.
- The science is accurate.
- It is easy for anyone to understand.
- No grammar errors or spelling errors.

✓ Visuals & Design

- Visuals, graphics, or drawings are used (handmade or digital without AI).
- The flyer is colorful, neat, and eye-catching.
- Humor or irony (if used) is school-appropriate and strengthens the message.
- Final product is original and shows real effort.